

Performance of Large-Scale Xenon Doping Liquid Argon in ProtoDUNE

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The Deep Underground Neutrino Experiment (DUNE) employs large liquid argon time projection chambers (LArTPCs) to address key questions in neutrino physics and astroparticle physics. Efficient detection of scintillation light is essential for event timing, triggering, and low-energy physics, motivating studies of liquid argon doped with xenon as a wavelength-shifting and light-enhancing medium. This presentation summarizes the xenon-doping studies performed in the ProtoDUNE Single-Phase detector at CERN in 2020. Xenon was injected at concentrations up to tens of parts per million, allowing the first systematic investigation of xenon-doped liquid argon scintillation in a kiloton-scale detector. Results on light yield, pulse-shape evolution, and response uniformity are presented, including effects observed under nitrogen contamination and the extent to which xenon mitigates quenching. The results demonstrate the feasibility and stability of xenon doping in a large detector volume and provide important input for the design of future DUNE photon detection systems. We conclude with a brief overview of the extension of this program to ProtoDUNE-VD, the vertical drift prototype.

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